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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 09/727,516
Filing Date: December 04, 2000
Appellant(s): KIM ET AL.

Esther H. Chong
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed January 22, 2007 appealing from the Office action mailed August 23, 2006.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 6,350,322 B1 | YATES | 02-2002 |

Admitted prior art, from applicant's specification (pages 1-2 and Figure 1)

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 4-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Yates (US 6,350,322 B1).

Admitted prior art discloses a method comprising:

introducing an etching solution (10b, Fig.1) into the vessel 10 from below the objects;

etching the objects with the etching solution;

cleaning the objects by introducing a cleaning solution 10c into vessel from below the objects (Fig.1); and

draining the cleaning solution from the vessel from above the objects (through first draining pipe 10d).

Admitted prior art fails to disclose to introduce pressurized gas into the vessel from above the objects.

Yates teaches a method comprising:

forcing out (wet) etching solution from the vessel and providing pressurized gas into the vessel (col.11, lines 15-25, the "purging step" and "forming an inert gas atmosphere" step).

Yates does not explicitly disclose in column 11 how the etching solution is displaced from the vessel.

In the second embodiment in which etching, cleaning and drying are all done in the same chamber, Yates teaches (col.6, lines 26-30):

> In a second embodiment of the present invention, the chemical treatment is an HF gas etch, by way of non-limiting example. Other etching may be carried out, such as wet or dry etching. Following the chemical treatment, a DI water rinse followed by drying is carried out. Single-

The embodiment is primarily directed to dry etching, so there is no description of how a wet etchant would be drained from the apparatus. However, Yates discloses in the claims that after wet etching, that inert gas is supplied to the chamber (col.11, lines 15-26):

**23.** A method of cleaning a semiconductor structure comprising:

performing a chemical reaction wet etching upon said semiconductor structure within a single compartment of an at least substantially enclosed vessel;

purging the single compartment of said vessel with a gas;

forming an inert gas atmosphere in the single compartment of said vessel, said gas forming said inert gas atmosphere being inert to said semiconductor structure and to said vessel;

contacting said semiconductor structure with DI water;

Yates teaches that the inert gas atmosphere, such as nitrogen gas, avoids unwanted oxidation or other contamination incident to ambient air exposure that may occur during or after rinsing (col.5, lines 4-6, 13-14).

After wet etching, the chamber is purged and then cleaning is conducted. There is no intermixing of the etching solution and the cleaning solution, and thus no change in the density of either the etching solution or the cleaning solution. Rather, inert gas is introduced that is inert to the semiconductor structure.

After providing an inert gas atmosphere, cleaning is conducted (the "contacting...with DI water" step). Thus Yates does not explicitly disclose how the wet etching solution is displaced from the chamber. However, it would have been obvious to one with ordinary skill in the art that the wet etchant is drained from the chamber in the same manner, i.e. from below the object, as a cleaning solution because otherwise the apparatus would have to be redesigned to provide a different manner for draining the wet etchant, which costs time and money.

It would have been obvious to one with ordinary skill in the art to force the wet etchant out by introducing a pressurized gas in the method of Yates because the next step in the method of Yates is to introduce a gas, and it would save time and money to introduce the inert gas while the wet etchant is draining rather than to wait. Alternatively, since wet etching does not occur within a vacuum, some atmosphere or gas is inherently present in the wet chamber during draining of the wet etchant.

Yates does not explicitly disclose that draining of etchant from the wet etch chamber occurs by introducing a pressurized gas from above the objects to force the etching solution out from below the objects. However, this is suggested because Yates does disclose this in order to drain the cleaning solution from the gas etch chamber (col.6, lines 56-60):

> The method of draining the gas etch chamber by displacing the DI water bath with a gas or a vapor, or both, can be accomplished by installing an effluent valve, as seen in FIGS. 1–3, in the gas etch chamber at a level below the lowest portion of the semiconductor structure. A preferred

It would have been obvious to one with ordinary skill in the art to drain the etching solution from the wet etch chamber by introducing a pressurized gas from above the objects to force the etching solution out from below the objects in the method of Yates because Yates teaches that this is useful for draining the wet cleaning solution, and in order to save time and money, it would be useful to use this same method to drain other wet solutions such as wet chemical etching solutions.

It would have been obvious to one with ordinary skill in the art to introduce a pressurized gas into the vessel from above the objects to force the etching solution out of the vessel from below the objects in the method of admitted prior art as taught by the modified method of Yates

because Yates teaches that this is a useful manner to do so and introducing gases reduces unwanted oxidation and contamination of substrates, which increases the yield of the final product.

As to claim 5, the method of admitted prior art suggests to use pipes 10d for draining the cleaning solution and pipe 10e for draining the etching solution. Still further, apparatus limitations are given little weight in method claims. Apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims. *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

In addition, it would have been obvious to use different draining pipes so that the etching solution is capable of being regenerated and reused, which saves time and money, rather than being mixed with the cleaning solution.

As to claim 6, Yates does not disclose the gas used for purging. However, Yates does teach that nitrogen is a useful gas for filling vessels because it is inert to both the semiconductor structure and the vessel (col.5, lines 6-16). This in turn would increase the final yield by reducing contamination of the final product. It would have been obvious to one with ordinary skill in the art to use nitrogen in the method of admitted prior art because Yates teaches that it is inert to the object and to the vessel, which reduces contamination.

As to claim 7, Yates discloses to use HF, not oxalic acid. However, oxalic acid is a well known oxidizing agent. It would have been obvious to one with ordinary skill in the art to use

oxalic acid as a treatment liquid in the method of Yates because it is a conventional treatment liquid for semiconductor structures.

As to claim 8, Yates discloses deionized water (col.11, lines 33-34), which is obvious to use in the method of admitted prior art because it is a useful cleaning solution.

As to claim 9, it would have been obvious to one with ordinary skill in the art to use a pump to enhance the step of forcing out the etching solution because pumps are conventional to drain liquids. Further, apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims. *In re Tarczy-Hornoch* 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

As to claims 10-11, admitted prior art discloses drying with IPA (through 10a).

As to claim 12, it would have been obvious to clean after purging the etching solution by introducing the gas because Yates teaches that it is useful to clean after etching and after introducing the gas.

As to claims 13-20, see the rejection of claims 4-12.

**(10) Response to Argument**

Appellant argues "that Examiner has correctly acknowledged that Yates fails to teach draining etchant from the wet etching chamber by introducing a pressurized gas into the vessel from above the objects to force the etching solution out of the vessel from below the objects," as recited in claim 4. In response, Yates does not discuss how the etching solution is drained, only how the rinsing solution is drained (col.6, lines 56-60):

> The method of draining the gas etch chamber by displacing the DI water bath with a gas or a vapor, or both, can be accomplished by installing an effluent valve ... in the gas etch chamber at a level below the lowest portion of the semiconductor structure.

Thus the rinsing solution is drained from below the objects, and examiner has argued that the etching solution would be drained in the same manner as the rinsing solution (because otherwise the chamber would have to be redesigned).

Appellant argues that Yates discloses that inert gas is used to avoid oxidation or other contamination incident to ambient air exposure that may occur during and after rinsing. In response, the same advantage is expected prior to rinsing.

Appellant argues that there is no disclosure of using gas to drain the wet etchant. In response, Yates does disclose how to drain water, and it is obvious to drain etchant in the same manner as discussed in the rejection.

Appellant argues about inert gas is purged into the vessel after the aqueous HF is discarded, and not used to drain the aqueous HF. In response, this is not in conflict with the claimed invention. The etchant is displaced with an inert atmosphere. This is also discussed in column 3, lines 11-34. Yates, at col.3, lines 27-28, discusses how the vessel is drained by displacing the DI water bath with IPA-laden nitrogen gas. This also suggests that the claimed invention is obvious because the wet solution (which examiner argues can be a wet etchant rather than a rinsing solution) is displaced with a gas atmosphere.

Appellant argues that it is an improper conclusion that one would drain wet etchant in the same manner as draining the cleaning solution of DI water. In response, the vessel would have to be redesigned, which it is not, and therefore the water must drain in the same manner as the etchant.

Appellant argues that Yates does not teach how the etching solution is drained out of the rinser 40/42. In response, all of the figures of Yates show draining from below the substrates, and it is obvious to drain the wet etchant in the same manner as a water rinsing solution.

Appellant argues that examiner admitted that Yates fails to teach draining the etchant by introducing pressurized gas, and the feature is expected to be drained in the same manner as the cleaning solution and about hindsight reconstruction. In response, Yates drains water, not etchant, but to drain etchant is obvious, as discussed in the rejection.

Appellant argues that modifying the admitted prior art with Yates' teaching would fail to teach "draining the cleaning solution from the vessel from above the objects" as recited in claim 4. In response, the draining of the cleaning solution is disclosed by admitted prior art, and Yates is not relied upon to teach this feature.

Appellant argues that, using the combination of references, there would be no need to drain the DI water from above the objects. In response, the primary reference discloses how to drain the cleaning solution. Still further, considering the open "comprising" claim language, there can also be more than one rinse step to ensure a clean process and that the etchant is removed. There can be numerous ways to drain, and they do not negate previous ways to drain.

Appellant argues that the inlet and outlet directions of the solution are important factors for a process and are not obvious. In response, the directions are taught by Yates. If they were changed, that would be redesigning the chamber, which examiner argues would not be done because one would drain the etchant and the rinsing solution in the same manner.

Appellant argues on page 14, that the combination of applied art fails to teach "draining the cleaning solution from the vessel from above the objects." In response, this is disclosed by admitted prior art.

On page 14, appellant disagrees about redesigning the chamber, and that there could be different inlet and outlet directions of the solution such that positions are different. In response, that would be redesigning the chamber, which examiner argues Yates would not do when draining a wet etchant from a chamber that already has a means to drain a water rinsing solution.

Appellant argues about the examiner's opinion without providing any reference to support her allegation. In response, it is obvious to drain from the bottom – this also happens with the common household dishwasher. However, examiner has applied Yates because Yates teaches etching, cleaning, drying of semiconductor wafers, all in the same vessel.

The arguments on pages 16-21 repeat from arguments on pages 10-15, and examiner's response is also repeated.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Anita K. Alanko

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Conferees:

Nadine Norton

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